The role of chromate in the mechanisms of passivation and repassivation of undermining coatings on hot-dip galvanized steel surfaces.

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Chromate is used as conversion coating and in the primer for coil-coated steel used in the building industry. Chromate provides excellent corrosion protection at defected areas and at the cut-edge of these materials. However, chromate is toxic and a suspected carcinogen. Hence there is a need to develop environmentally friendly alternatives for application to coil-coated materials. A better understanding of the mechanisms of corrosion protection of chromate is believed to foster the development of chromate free coil-coated steel.

In this work, scanning Kelvin probe (SKP) has been used for *in situ* determination of the distribution of the difference in Volta potential at the metal/ thin electrolyte interface. The measurements provided information at the micron scale about active/passive transitions under atmospheric weathering conditions. The mechanisms of inhibition of conversion coatings and chromate containing primers have been studied using the Scanning Kelvin probe. From the results it is shown that information concerning adsorption of chromate and the ability to inhibit the oxygen reduction as well as the passivation properties may be obtained. X-ray absorption near-edge structure (XANES) was used to measure both the distribution of chromium and the proportion of hexavalent chromium. The measurements were performed after exposure to humid air. Additional Fourier Transform Infrared Spectroscopy (FTIR) measurements were performed to analyse the surface films formed on zinc surfaces during exposure to various weathering conditions. From the results the role of chromate in the passivation/repassivation of undermining coatings on hot-dip galvanised steel surfaces is discussed. This includes the role of Cr(VI) and Cr (III) in the passivation/repassivation processes as well as the kinetics of reduction of Cr(VI) to Cr(III) on hot-dip galvanised steel during exposure to various atmospheric weathering conditions.